

15  
Physico-chemical properties and structure of monocrystalline samples of  $\text{ZnSiAs}_2$ . A. A. Vaypolin, N. A. Goryunova, E. O. Osmanov.

Investigation of macrocrystalline  $\text{ZnSiP}_2$ . N. A. Goryunova, A. A. Vaypolin, Yu. V. Rud'.  
A. A. Vaypolin, Yu. V. Rud'.

Some properties and zone structure of the ternary compound  $\text{CdGeAs}_2$ . F. M. Gashimzade, N. A. Goryunova, E. O. Osmanov.

Electrical properties of monocrystalline samples of  $\text{ZnSnAs}_2$ . N. A. Goryunova, F. P. Kesamanly, D. N. Nasledov, Yu. V. Rud'.

Investigation of properties of  $\text{ZnGeP}_2$  and  $\text{CdGeP}_2$ . N. A. Goryunova, N. K. Takhtorova, I. I. Tychina.

On the question of the existence of homogeneous many-component tetrahedral phases. G. K. Aberkiyeva, A. A. Vaypolin, N. A. Goryunova.

X-Ray investigation of certain compounds of the type  $A^{II}_3C_2^{IVVI}$ . A. A. Vaypolin, E. O. Osmanov, Yu. V. Rud', I. I. Tychina, A. F. Lindin, N. A. Goryunova, M. F. Tyovishin.

L 32211-65 EWT(m)/EWP(w)/EWA(d)/T/EWP(t)/EWP(b) IJP(c) RDW/JD/GS

ACCESSION NR: AT5005411

S/0000/64/000/001/0010/0010

AUTHOR: Borshchevskiy, A. S.; Takhtareva, N. K.; Tret'yakov, D. N.

34  
B+1

TITLE: Microhardness of some complex diamond-like semiconductors

SOURCE: Nauchnaya konferentsiya molodykh uchenykh Moldavii, 3d. Trudy, no. 1:  
Yestestvenno-tekhnicheskiye nauki (Natural and technical sciences). Kishinev,  
Gosizdat Kartya Moldovenyaske, 1964, 10

TOPIC TAGS: semiconductor, diamondlike semiconductor, heterovalent semiconductor, semiconductor hardness

ABSTRACT: Fifty heterovalent semiconducting compounds (with two or three components) were prepared, representing five open isoelectron series derived from germanium, selenium, antimony, gallium, arsenic, indium, tellurium and other elements. A study of the quantitative dependence of microhardness on the composition of the isovalent solid solution of diamondlike substances yielded the formula

$$H^* = (H_a^* - H_b^*) N_a + H_b^* + K N_a (1 - N_a),$$

where  $H_a^*$  and  $H_b^*$  are the microhardnesses of the starting components "a" and "b", reduced to an equal number of bonds;  $N_a$  = molar portion of the "a" component

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ACCESSION NR: AT5005411

within the alloy;  $K = \text{constant}$ ; and  $H^*$  = reduced microhardness of the alloy.  
Orig. art. has: 1 formula and 1 table.

ASSOCIATION: None

SUBMITTED: 07Feb64

ENCL: 00

SUB CODE: SS, MT

NO REF SOV: 000

OTHER: 000

Card 2/2

ACCESSION NR: AP4041359

S/0048/64/028/006/0985/0988

AUTHOR: Borshchevskiy, A.S.; Kalyuzhnaya, G.A.; Smirnova, A.D.; Takhtareva, N.K.;  
Tret'yakov, D.N.

TITLE: Morphological characteristics of laminar gallium phosphide crystals /Report,  
Third Conference on Semiconductor Compounds held in Kishinev 16-21 Sep 1963/

SOURCE: AN SSSR. Izvestiya. Seriya fizicheskaya, v.28, no.6, 1964, 985-988, and  
insert facing p. 988

TOPIC TAGS: crystal structure, crystal growth, gallium compound

ABSTRACT: Gallium phosphide crystals were obtained by slowly cooling dilute solutions of phosphorus in gallium and subsequently separating the precipitated crystals from the excess gallium, as proposed by G.Wolff, P.H.Keck and J.D.Broder (Bull. Amer.Phys.Soc.29,116,1954). The crystals thus obtained had the zincblende structure, were laminar in form with the (111) faces developed, and ranged in size from  $15 \times 10 \times 1 \text{ mm}^3$  to a few hundred microns. The pure crystals were light orange in color and uniformly transparent. The crystal plates had the form of equilateral triangles,  $60^\circ$  rhombi, regular hexagons, or were of mixed shape. A drawing showing the faceting of the simplest rhombic crystals is given in Fig.1 of the Enclosure. The two

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ACCESSION NR: AP4041359

well developed (111) faces reacted differently to etching with HCl: one face retained its initial specular luster, and the other acquired a mat surface. This polarity is attributed to the regular alternation of planes consisting of gallium or phosphorus atoms respectively. Triangular etch pits marking dislocations were observed on the (111) faces. The dislocation density varied greatly even from place to place on the same crystal, and the total variation among the crystals was from  $10^3$  to  $10^6$  cm<sup>-2</sup>. Twinning planes parallel to the developed (111) faces were found; the twinning appeared to involve rotation of the two portions of the crystal about the  $\langle 111 \rangle$  axis. Dark lines were also observed marking the long diagonal of the rhombic plates; these are believed to mark the central portion of the dendritic structure. The growth of the crystals is discussed at some length in rather general terms. It is concluded that the laminar form is a consequence of the non-equilibrium conditions and the excess of one component, that more than one growth mechanism is involved, and that growth probably proceeds differently in the  $\langle 111 \rangle$  and the  $\langle \bar{1}\bar{1}\bar{1} \rangle$  directions. Orig.art.has: 3 figures.

ASSOCIATION: none

SUBMITTED: 00

ENCL: 01

SUB CODE: SS,IC

NR REF SOV: 001

OTHER: 002

Card 2/3

ACCESSION NR: AP4041359

ENCLOSURE :01

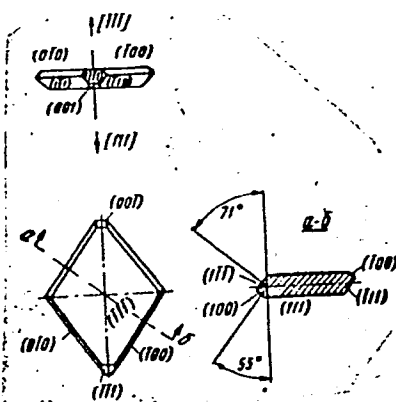


Fig.1. Faceting of rhombic laminar gallium phosphide crystals.

Card 3/3

L 35355-66 EWT(m)/T/EWP(t)/ETI IJP(c) JD/JG

ACC NR: AR6017804

SOURCE CODE: UR/0058/66/000/001/A065/A065

AUTHOR: Borshchevskiy, A. S.; Kalyuzhnaya, G. A.; Smirnova, A. D.; Takhtareva, N. K.

TITLE: Influence of impurities on the crystallization of gallium arsenide and phosphide from metallic solutions

SOURCE: Ref. zh. Fizika, Abs. 1A552

REF SOURCE: Sb. Materialy dokl. 1-y Nauchno-tekhn. konferentsii Kishinevsk. politekhn. in-ta. Kishinev, 1965, 65-66

TOPIC TAGS: gallium compound, gallium arsenide, crystallization, crystal impurity

ABSTRACT: The authors investigated the influence of Cu, Zn, Cd, Si, Ge, Sn, Se, Te, and rare-earth metals (Me) as contained in the gallium as impurities on the crystallization of GaAs and GaP from liquid solutions. The amounts of impurities and the crystallization conditions varied over a wide range. Estimates are given of the chemical activity of the obtained crystals, their electric conductivity, hardness, and thermal-emf coefficients. The coefficients of effective distribution in GaP crystallized from a dilute solution is  $K_{effZn} = 0.02$ ,  $K_{effTe} = 0.4$ , and  $K_{effS} = 1.3$ . Plate-like GaP and GaAs crystals with prescribed impurity content were obtained. A. Rabin'kin. [Translation of abstract]

SUB CODE: 20, 07

Card

1/1

ADP 00021761

SOURCE CODE: UR/0275/66/000/003/B015/B015

AUTHOR: Boronchevskiy, A. S.; Kalyuzhnaya, G. A.; Smirnova, A. D.; Takhtareva, N. K.

TITLE: Effect of impurities on crystallization of gallium arsenide and phosphide from metal solutions

SOURCE: Ref. zh. Elektronika i yeye primeneniya, Abs. 3B117

REF SOURCE: Sb. Materialy dokl. 1-y Nauchno-tekhn. konferentsii Kishinevsk. politekhn. in-ta. Kishinev, 1965, 65-66

TOPIC TAGS: gallium arsenide, gallium phosphide, crystallization, semiconductor

ABSTRACT: The effect of Cu, Zn, Cd, Si, Ge, Sn, Se, Te, and rare-earth metals as impurities in Ga upon the crystallization of GaAs and GaP from liquid solutions of Ga with As and P was studied. The amount of impurities and the conditions of crystallization were widely varied. The chemical activity, electric conductivity, hardness, and thermo-emf of the resulting GaAs and GaP crystals were measured. In GaP crystallization from dilute solutions, the effective distribution coefficients were: Zn -- 0.02, Te -- 0.4, S -- 1.3. Slaty crystals of GaP and GaAs with specified impurity contents were produced. A. R. [Translation of abstract]

SUB CODE: 09/20

Card 1/1

UDC: 621.315.592:548.552:546.681:18/19



ROGALIN, P.D.; KRIVENKO, G.N.; NIKITINA, N.A.; KATELLO, F.A.; TAKHTAROV,  
M.Kh., red.; SHCHERBAN', I.I., red.; TIMOSHEVSKAYA, A.A., tekhn.  
red.

[Innovators clear the way] Dorogu prokladyvaiut novatory. Stalino,  
Knizhnoe izd-vo, 1960. 138 p. (MIRA 14:10)  
(Agricultural research)

TAKHTAROV, Anatoliy Taukenovich; BOGDANOV, Ye.A., red., GRZHEGORZHEVSKIY, A.N., kand..ekon. nauk, dots., red.; MARTYNOVA, M.N., tekhn. red.

[Technological development in agricultural machinery manufacture and the increase of labor productivity; based on the materials on agricultural machinery manufacture of the Central Asian Economic Council] Tekhnicheskii progress v sel'skokhoziaistvennom mashinostroenii i rost proizvoditel'nosti truda; na materialakh sel'skokhoziaistvennogo mashinostroeniia Sredneaziatskogo sovnarkhoza. Moskva, Izd-vo "Mysl'," 1964. 87 p.

(MIRA 17:3)

1. TAKHTAROV, Ye. M. and FEDOTOV, V. V.
2. USSR (600)
4. Sand - Chitomir Province
7. Geological report of the Dnepropetrovsk party for vitreous sands (on the activities of 1945). (Abstract.) Izv.Glav.upr.geol.fon. no. 3, 1947.
9. Monthly Lists of Russian Accessions, Library of Congress, March 1953, Unclassified.

TOPCHIEVA, K.V.; TAKHTAROVA, G.N.; FOMINA, A.I.

Vapor-phase esterification of aromatic acids with ~~ethers~~ on oxide catalysts. Neftekhimiia 2 no.5:744-749 S-O '62. (MIRA 16:1)

1. Moskovskiy gosudarstvennyy universitet imeni Lomonosova, khimicheskii fakul'tet.

(Acids, Organic) (Esterification) (Ethers)

ANTONOVSKAYA, E.I.; TAKHTAROVA, L.V.

Corrosion of metallic materials in aqueous solutions of fluorides at elevated temperatures. Zhur.VKHO 6 no.4:477-478 '61. (MIRA 14:7)

1. Gosudarstvennyy institut prikladnoy khimii.  
(Corrosion and anticorrosives) (Fluorides)

TAKHTAULOV, M.

Inventions and innovations are basic means for technological progress.  
Blok.agit.vod.transp.no.23:10:16 D '56. (MLRA 10:2)  
(Merchant marine)

TAKHTAY, I.I.; LYUBCHENKO, L.I.

Accelerated method for determining total soil phosphorus.  
Pochvovedenie no.3:98-100 Mr '61. (MIRA 14:3)

1. Kamenets-Podol'skiy sel'skokhozyaystvennyy institut.  
(Soils--Phosphorus content)

TAKHTAYEV, Yu.B.; IVANOV, R.M.; LEONOV, A.F.; VARNAVSKIY, I.N.;  
IZOTOV, N.I.; MUSIKHINA, M.K.

Improved technology for the making of native alloy  
steel at the Orsk-Khalilovo Metallurgical Combine.  
[Sbor. trud.] Nauch.-issl.inst.met. no.4:82-90 '61.

(MIRA 15:11)

1. Nauchno-issledovatel'skiy institut metallurgii (for  
Takhtayev, Ivanov). 2. Orsko-Khalilovskiy metallurgicheskiy  
kombinat (for Leonov, Varnavskiy, Izotov, Musikhina).  
(Khalilovo--Steel--Metallurgy)



LEONOV, A.F.; MOROZOV, A.N.; IVANOV, R.M.; VARMAVSKIY, I.N.;  
TAKHTAYEV, Yu.B.; IZOTOV, N.P.; VOLKOV, S.S.

Smelting of native-alloy steel. Metallurg 6 no.10:20-21  
0 '61. (MIRA 14:9)

1. Orsko-Khalilovskiy metallurgicheskiy kombinat i  
Chelyabinskiy nauchno-issledovatel'skiy institut metallurgi.  
(Steel alloys--Metallurgy)

ORANSKIY, L.; TAKHTOVICH, G.

Production of vanillin at the sulfite-alcohol plant in Thorold (Canada).  
Gidroliz.lesokhin.prom.9 no.6:29 '56. (MIRA 9:10)  
(Thorold, Canada--Vanillin)

TAKHTOVICH, G.A.; SHAMSONOV, S.M.; SERGEYEV, A.P.

Wood as a chemical raw material. Gidroliz. i lesokhim. prom.  
10 no.3:29-30 '57. (MLRA 10:5)

1. Vsesoyuznyy nauchno-issledovatel'skiy institut gidroliznoy  
i sul'fitno-spirtovoy promyshlennosti.  
(Wood--Chemistry)

TAKHTOVICH, G.A.; SHAMSONOV, S.M.

Continuous method of producing furfurole. Hidroliz. i lesokhim.  
prom. 11 no.5:31 '58. (MIRA 11:9)

1. Vsesoyuznyy nauchno-issledovatel'skiy institut gidroliznoy i  
sul'fitno-spirovoy promyshlennosti.  
(Furaldehyde)

BELEVTSSEV, Yakov Nikolayevich; BURBA, Galina Georgiyevna; DUBINKINA, Raisa Pavlovna; YEPATEKO, Yuriy Mikhaylovich; ISHCHENKO, Dmitriy Ivanovich; MEL'NIK, Yuriy Petrovich; STRYGIN, Aleksey Il'ich. Prinimali uchastiye: KOZHARA, V.L.; KRAVCHENKO, V.M.; TAKHTUYEV, G.V.; SHCHERBAKOVA, K.F.. RODIONOV, S.P., otv.red.; ZAVIRYUKHINA, V.N., red. izd-vo; YEFIMOVA, M.I., tekhn.red.

[Genesis of iron ores in the Krivoy Rog Basin] Genezis zheleznykh rud Krivorozhskogo basseina. Kiev, Izd-vo Akad.nauk USSR, 1959. 306 p. (MIRA 13:2)

1. Chlen-korrespondent AN USSR (for Rodionov).  
(Krivoy Rog Basin--Iron ores)

BELEVTSSEV, Yakov Nikolayevich; TAKHTUYEV, Gleb Vasil'yevich; GOROSHNIKOV,  
Boris Ivanovich; BIRYUKOV, V.I., red.; OVCHINNIKOVA, S.V., red.  
izd-va; GUROVA, O.A., tekhn. red.

[Mining geology of iron ore deposits] Rudnichnaia geologiya na  
zhelezorudnykh mestorozhdeniiakh. Moskva, Gosgeoltekhizdat,  
1962. 233 p.

(Iron ores)

(MIRA 16:2)

BELEVTSSEV, Ya.N.; FOMENKO, V.Yu.; NOTAROV, V.D.; MOLYAVKO, G.I.; MEL'NIK, Yu.P.; SIROSHTAN, R.I.; DOVGAN', M.N.; CHERNOVSKIY, M.I.; SHCHERBAKOVA, K.F.; ZAGORUYKO, L.G.; GOROSHNIKOV, B.I.; AKIMENKO, N.M.; SEMERGEYEVA, Ye.A.; KUCHER, V.N.; TAKHTUYEV, G.V.; KALYAYEV, G.I.; ZARUBA, V.M.; NAZAROV, P.P.; MAKSIMOVICH, V.L.; STRUYEVA, G.M.; KARSHENBAUM, A.P.; SKARZHINSKAYA, T.A.; CHEREDNICHENKO, A.I.; GERSHOYG, Yu.G.; PITADE, A.A.; RADUTSKAYA, P.D.; ZHILKINSKIY, S.I.; KAZAK, V.M.; KACHAN, V.G.; STRYGIN, A.I., red.; LADIYEVA, V.D., red.; ZHUKOV, G.V., red.; YEPATKO, Yu.M., red.; SHCHERBAKOV, B.D., red.; SLENZAK, O.I., red. izd-va; RAKHLINA, N.P., tekhn. red.

[Geology of Krivoy Rog iron-ore deposits] Geologiya Krivorozhskikh zhelezorudnykh mestorozhdenii. Kiev, Izd-vo Akad. nauk USSR.

Vol.1. [General problems in the geology of the Krivoy Rog Basin.

Geology and iron ores of the deposits of the "Ingulets,"

Rakhmanovo, and Il'ich Mines] Obshchie voprosy geologii Krivbassa.

Geologicheskoe stroenie i zheleznye rudy mestorozhdenii rudnikov

"Ingulets," Rakhmanovskogo i im. Il'icha. 1962. 479 p.

(Krivoy Rog Basin--Mining geology)

(MIRA 16:3)

(Krivoy Rog Basin--Iron ores)

BELEVTSSEV, Ya.N.; FOMENKO, V.Yu.; NOTAROV, V.D.; MOLYAVKO, G.I.;  
 MEL'NIK, Yu.P.; SIROSHTAN, R.I.; DOVGAN', M.N.; CHERNOVSKIY,  
 M.I.; SHCHERBAKOVA, K.F.; ZAGORUYKO, L.G.; GOROSHNIKOV, B.I.;  
 AKIMENKO, N.M.; SEMERGEYEVA, Ye.A.; KUCHER, V.N.; TAKHTUYEV, G.V.;  
 KALYAYEV, G.I.; ZARUBA, V.M.; NAZAROV, P.P.; MAKSIMOVICH, V.L.;  
 STRUYEVA, G.M.; KARSHENBAUM, A.P.; SKARZHINSKAYA, T.A.;  
 CHEREDNICHENKO, A.I.; GERSHOYG, Yu.G.; PITADE, A.A.; RADUTSKAYA,  
 P.D.; ZHILKINSKIY, S.I.; KAZAK, V.M.; KACHAN, V.G.; POLOVKO, N.I.,  
 red.; LADIYEVA, V.D., red.; ZHUKOV, G.V., red.; YEPATKO, Yu.M.,  
 red.; SLENZAK, O.I., red. izd-va; KULICHENKO, V.G., red.;  
 RAKHLINA, N.P., tekhn. red.; MATVEYCHUK, A.A., tekhn. red.

[Geology of the Krivoy Rog iron ore deposits] Geologiya Krivo-  
 rozhskikh zhelezorudnykh mestorozhdenii. Kiev, Izd-vo Akad. nauk  
 USSR. Vol.1.[General problems of the geology of the Krivoy Rog  
 Basin. Geology and iron ores of the "Ingulets," Rakhmanovskiy,  
 and Il'ich ore deposits] Obshchie voprosy geologii Krivbassa.  
 Geologicheskoe stroenie i zheleznye rudy mestorozhdenii rudnikov  
 "Ingulets," Rakhmanovskogo i im. Il'icha. 1962. 479 p. Vol.2.[Ge-  
 ology and iron ores of the Dzerzhinskiy, Kirov, Liebknecht, October  
 Revolution, "Bol'shevik, " Frunze, 22d Parts'ezd, Red Guard, and  
 Lenin deposits]Geologicheskoe stroenie i zheleznye rudy mestorozhdenii  
 im. Dzerzhinskogo, im.Kirova, im.K.Linkenkhta, im.XX parts'ezda, im.  
 Krasnoi Gvardii i im.Lenina. 1962. 564 p. (MIRA 16:5)  
 (Krivoy Rog Basin--Iron ores)



1.7.1. H Y H A N O V, G. I.

VEREBRYUSOV, I.A., dotsent, kandidat tekhnicheskikh nauk; AFOSHIN, A.N., kandidat tekhnicheskikh nauk, redaktor; NOVOSEL'TSEV, Ya.V., kandidat tekhnicheskikh nauk, retsenzent; SMOLOV, V.B., kandidat tekhnicheskikh nauk, retsenzent; TAKHVANOV, G.I., kandidat tekhnicheskikh nauk, retsenzent; PETERSON, M.M., tekhnicheskii redaktor

[Synchro transfer and servomechanisms] Sinkhronnye peredachi i slediashchie sistemy. Leningrad, Gos. soiuзное nauchno-tekhn. izd-vo sudostroitel'noi promyshl., 1954. 240 p. (MLRA 7:10)  
(Servomechanisms) (Automatic control)

TAKHVANOV, G.I.

AID P - 641

Subject : USSR/Electricity

Card 1/1 Pub. 27 - 10/34

Authors : Novosel'tsev, Ya. V., Kand. of Tech. Sci., Smolov, V. B.,  
Kand. of Tech. Sci. and Takhvanov, G. I., Kand. of Tech.  
Sci., Leningrad

Title : Vacuum-tube functional converters for multiplying voltages

Periodical : Elektrichestvo, 9, 45-49, S 1954

Abstract : A computing arrangement for multiplication of two voltages  
 $U_1$  and  $U_2$  is based on equation  $U_1 U_2 = \frac{1}{2} [(U_1 + U_2)^2 - (U_1 - U_2)^2]$ .  
The raising to the square is performed by a vacuum tube  
circuit, the theory and diagram of which are presented.  
9 diagrams.

Institution : Leningrad Institute of Electrical Engineering im.  
Ul'yanov (Lenin)

Submitted : Ap 20, 1954

TAKHVANOV, G.I.

Universal summing amplifiers. Priborostroenie no.4:10-11 Ap '57.

(MLRA 10:5)

(Electromechanical analogies)

ANISE OV, B.V.; CHEVERNIKOV, V.M., KORBINSKIY, I. Ye., doktor tekhn. nauk, prof., retsenzent; TAKHVANOV, G.I., kand. tekhn. nauk, retsenzent; LOBROGURSKIY, S.O., doktor tekhn. nauk, red.; YELISEYEV, M.S., red. izd-va; EL'KIND, V.D., tekhn. red.

[Fundamentals of the theory and design of digital computers]  
Osnovy teorii i proektirovaniia tsifrovyykh vychislitel'nykh mashin. Moskva, Mashgiz, 1962. 431 p. (MIRA 15:10)  
(Electronoc digital computers)

L 16361-65 ESD(dp)/SSD/BSD/AFWL/ASD(a)-5/AFMD(p)/AFETR

ACCESSION NR: AT4045639

S/2943/64/000/002/0003/0021

AUTHOR: Takhvanov, G. I.; Shkhalakhov, Yu. Sh.

B+1

TITLE: On the construction of pulse models with a feedback

SOURCE: Seminar pometodam matematicheskogo modelirovaniya i teorii elektricheskikh tsepey. Matematicheskoye modelirovaniye i elektricheskiye tsepi (Mathematical modeling and electrical circuits); trudy\* seminar, no. 2, Kiev, Izd-vo Naukova dumka, 1964, 3-21

TOPIC TAGS: analog computer, digital computer, computing solving machines, electronic modeling, pulse, digital model synthesis, linear algebraic equation

ABSTRACT: The modern specialized instrumentation requires compensation arrangements which combine the speed of electronic analog systems with the high accuracy of the digital computers. In order to combine these characteristics it appears desirable to change from a "continuous" to pulse modeling. The present survey was presented in a seminar summarizing the new developments

Card 1/2

L 16361-65

ACCESSION NR: AT4045639

published in the Soviet and foreign literature. Orig. art. has: 12 figures

ASSOCIATION: None

SUBMITTED: 25Jan63

ENCL: 00

SUB CODE: DP, EC, MA

NO REF SOV: 006

OTHER: 002

Card 2/2

L 8509-65 BSD/AEDC(a)/AFETR/AFTC(a)/AFWL/RAEM(a)/ASD(a)-5/ESD(c)/ESD(dp)/  
RAEM(t)

ACCESSION NR: AT4046528

S/2976/64/000/004/0170/0188

AUTHOR: Takhvanov, G. I.; Shkhalakhov, Yu. Sh.

TITLE: The problem of building pulse models with feedback

B

SOURCE: Moscow. Vysshaye tekhnicheskoye uchilishche. Vyshislitel'naya tekhnika,  
no. 4, 1964, 170-188

TOPIC TAGS: simulation, electronic simulation, pulse model, feedback, control  
computer, negative pulse feedback, digital integrator

ABSTRACT: The article reviews possible ways of improving electronic simulation devices, proposes a technical means for constructing pulse models with feedback, and cites examples to illustrate the use of this technique. The authors show why, at least in the area of control computers, it is expedient to make a transition from "constant-level" analog engineering, with its inherent accuracy limitations, to pulse simulation engineering through the development of a complex of highly-specialized pulse circuits and systems (adding, multiplying-dividing, integrating-differentiating, functional devices, etc.), which will provide a direct realization of the required functions without the need for converting the character of the information from one type to another. The advantages which would flow from such a

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L 8509-65

ACCESSION NR: AT4046528

transition are discussed. In their discussion of this transition from "continuous" simulation to pulse (time-pulse, number-pulse) simulation, the authors direct particular attention to the problem of direct methods of achieving negative pulse feedback, and to techniques for comparison and processing of time-interval durations, pulse-frequency trains, etc., without their conversion into any of the analog forms. The familiar method used in the construction of continuous models is then extended, by means of these techniques and equipment, to pulse models. Digital integrators with consecutive and parallel carry-over are analyzed, the principle of comparing the position of the pulses of the input and processed frequency trains in time, rather than their quantitative comparison, is discussed, and the conditions for the realization of period comparison and the construction of an optimal servo system are outlined. The authors explain the value and the sign of the increment  $\Delta N$ , which ensures the existence of negative feedback in a closed "storage counter - control circuit - reserve counter" system. A structural diagram of a pulse-frequency servo system with optimum transient characteristics is presented and analyzed. The examples proposed, which illustrate the possible use of the system described in the paper, relate to the field of mathematical simulation, with the system output in the form of a digital binary code. Differences in the pulse-frequency and pulse-time form of representation of physical values are also discussed. In their estimation of the actually attainable accuracy levels

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ACCESSION NR: AT4046528

of computers built on the principles outlined in the paper, the authors state that these accuracy levels are determined wholly and exclusively by the values of the errors in transformation, in view of the fact that instrumentation (set) errors can be reduced to the required minimum through the choice of the proper bit-rate or place number for registers and dividers. The servo mechanisms considered in the article can be produced, it is claimed, through the use of the electronic, semiconductor or ferrite elements available to modern pulse engineering. Orig. art. has: 12 figures and 28 formulae.

ASSOCIATION: Moskovskoye vysshaye tekhnicheskoye uchilishche (Moscow School of Higher Technical Education)

SUBMITTED: 00

ENCL: 00

SUB CODE: DP, IE

NO REF SOV: 006

OTHER: 002

Card 3/3

LEYSHMAN, M.B.; BALASHOV, M.Ye.; AFANAS'YEV, A.S.; MIKHELEV, V.M.;  
TAKHVANOV, G.I.; SHKHALAKHOV, Yu.Sh.; SANNIKOV, Yu.I.; SLAVIN, A.A.;  
BEYRAKH, Z.Ya.; KAPLINSKIY, B.I.; ORLOV, O.A.; PEVZNER, V.V.;  
VALOV, O.V.; KIREYEV, V.V.

Inventions. Avtom. i prib. no.3:76-77 J1-S '64.

(MIRA 18:3)

TAKHVATULIN, A.

New individual life preserver. Mor.flat 19 no.4:27-28

Ap '59.

(MIRA 12:6)

1. Starshiy inzhener TSentral'nogo proyektного konstruktorskogo  
byuro-3.

(Life preservers)

SUBJECT USSR / PHYSICS CARD 1 / 2 PA - 1914  
 AUTHOR LOGUNOV, A.A., STEPANOV, B.M., TACHVELIDZE, A.N.  
 TITLE On the Part Played by Coupled States in the Processes of Photo-  
 production.  
 PERIODICAL Dokl. Akad. Nauk, 112, fasc. 1, 45-47 (1957)  
 Issued: 2 / 1957

The present paper deals with the part played by coupled states in the dispersion states of the processes of photoproduction. The study of this process is important because it is connected with the analysis of the not observable energy domain in dispersion relations. The authors investigate the energy domain

$E < | \vec{p} | + \mu^2/4 | p |$ , where the production of "coupled" states is possible. At first the antihermitic part of the amplitude of the reaction of photoproduction is explicitly written down. It is presumed that there are no coupled states of the meson-nucleon system between  $M$  and  $M + \mu$ . Here the domain of recoil momenta  $\vec{p}^2 < M\mu/2$  is investigated. The integration domain in the dispersion relations (which were mentioned in the works by A.A. LOGUNOV and B.M. STEPANOV, Dokl. Akad. Nauk, 110, No 3 (1956)) are then separated into two parts:

$0 < E' < (M\mu + (\mu^2/4) - \vec{p}^2) / \sqrt{M^2 + \vec{p}^2} < E' < \infty$ . Within the first domain only the one-nucleon states make a contribution to the integral which is different from zero, the states with  $n = 1$  make a contribution only by way of the second domain. Strictly spoken, the second domain contains a part of the unobservable energy domain. However, the contribution made by this part can be made arbitrarily small

Dokl. Akad. Nauk, 112, fasc. 1, 45-47 (1957) CARD 2 / 2

PA - 1914

if the recoil momentum is fixed in a suitable manner.

Next, the average values of the currents, which occur here, are investigated, and the average value of the meson current is computed by way of an example. The average value of the electromagnetic current is computed in a similar manner. For the average value of the meson current the following expression is obtained:

$\langle \hat{\Psi}_{p',s}, J_Q(0) \Psi_{p,s} \rangle = g \langle \bar{u}_s(p') \gamma^3 \gamma_Q u_s(p) \rangle$ . Here  $g$  is the renormalized pseudoscalar coupling constant of the meson- and nucleon fields. For the electromagnetic current one obtains:

$\langle \Psi_{p',s}, I_m(0) \Psi_{p,s} \rangle = \langle u_s(p') \{ e \frac{1+\tau_3}{2} \gamma^m + \frac{1}{2} \hat{M} [ (k), \gamma^m ] \} u_s(p) \rangle$ . Here  $e$  denotes the renormalized charge of the electron,  $\mu_p$  and  $\mu_n$  - the anomalous magnetic moments of the proton and the neutron and it holds that:  $\hat{M} = \mu_p \frac{1+\tau_3}{2} + \mu_n \frac{1-\tau_3}{2}$

With the help of the formulae just mentioned it is possible without any trouble to write down the dispersion equations for photoproduction, whereby the "coupled" states are taken into consideration and in which the non-observable energy domain is separated. The complete analysis of the dispersion relations in the approximation for a fixed source gives results which are equivalent to those obtained by G.F.CHEW and F.E.LOW, Phys. Rev. 101, 1579 (1956).

INSTITUTION: Moscow State University

TAKHIDAYEV, A. S.

AN INVESTIGATION OF THE ENERGY SPECTRUM OF PARTICLES  
GENERATED IN HIGH-ENERGY NUCLEAR INTERACTIONS

A. Kh. Vinitiskiy, I. G. Golyak, An. S. Takibayev,  
I. Ya. Chasnikov

A study was made of the energy spectrum of particles generated in high-energy nuclear interactions ( $\sim 10^{12}$  ev) in photographic emulsions. The energy of the charged shower particles was determined by measuring multiple Coulomb scattering. This method of determining the energy is a complex experimental problem, the difficulty being to distinguish spurious scattering from Coulomb scattering. This method of determining the energy is a complex experimental problem, the difficulty being to distinguish spurious scattering from Coulomb scattering. We utilized the procedure of evaluating and excluding spurious scattering by means of multiple cells and the higher differences of coordinates. The correctness of this procedure was verified on the tracks of protons of energy close to 9 Bev in nuclear emulsions irradiated on the proton synchrotron of the Joint Institute of Nuclear Research. Besides use was made for the very same purpose of certain published data on measurements of multiple scattering of particles accelerated by the bevatron.

Report presented at the International Cosmic Ray Conference, Moscow, 1-11 July 1959

TAKIBAYEV, Zh. G.

"Development of the Process of Interaction, according to the Powers of Charge in Classic Electrodynamics."  
Thesis for degree of Cand. Physicomathematical Sci.  
Sub. 28 May 49, Physics Inst imeni P. N. Lebedev, Acad Sci USSR.

~~DD~~ Summary 82, 18 Dec 52, Dissertations Presented For Degrees in Science and Engineering in Moscow in 1949. From Vechernyaya Moskva, Jan-Dec 1949.

PA 61/49176

USSR/Nuclear Physics - Interaction Aug 49  
Energy  
Nuclear Physics - Particles

"Energy of Interaction of Relativistic Particles in the Second Approximation Relative to Charge," Zh. S. Takhtabayev, Phys Inst Imeni P. N. Lebedev, Acad Sci USSR, 7 pp

"Zhur Eksper i Teoret Fiz" Vol XIX, No 8

(P. 680-87)

Considered a system consisting of two relativistic particles. Energy of interaction is represented as a power series expansion of the charge. Obtained a formula for that part of the interaction

61/49176

USSR/Nuclear Physics - Interaction Aug 49  
Energy (Contd)

energy which is proportional to the product of the charges of interacting particles. Obtained entire series for the interaction energy by introducing the proper time (dual-time convention) for each of the interacting particles. Series was made symmetric with respect to coordinates and speed of both particles. Same problem was also considered by the Hamilton-Jacobi method with the aid of the classical theory of perturbation developed by Markov. Submitted 29 Jan 49.

61/49176



TAKIBAYEV, Zh. S.

1A 10-572

USSR/Nuclear Physics - Scattering,  
Electrons

Oct 50

"Calculation of the Higher Approximations in the  
Scattering of Fast Electrons by Electrons," Zh. S.  
Takibayev, Phys Inst imeni Lebedev, Acad Sci USSR

"Zhur Eksper i Teoret Fiz" Vol XX, No 10, pp 898-904

Considers general method for calculating higher ap-  
proximations in the case of colliding electrons in  
applicability of classical electrodynamics. Ob-  
tains formula for magnitude of energy supplied to  
delta-electron taking into account fourth approxi-  
mation. Submitted 4 Feb. 50.

169T72

TAKIBAYEV, Zh. S.

USSR/Nuclear Physics - Cosmic Rays

21 May 51

"Transitional Effects of Strongly Ionizing Particles and "Stars" Recorded on Photoemulsion in the Stratosphere," Zh. S. Takibayev, Physico Tech Inst, Acad Sci Kazakh SSR.

"Dok Ak Nauk SSSR" Vol LXXVIII, No 3, pp 457-459

Anal of photographic plates exposed near Alma-Ata shows that "stars" formation under shielding of lead absorber 1.8 cm thick is twice as frequent as without it. Author was assisted by Prof S. N. Vernov, and by M. P. Ostyakov and Yu. T. Lukin, the latter 2 having organized flights into the stratosphere.

186T99 

TAKIBAYEV, Zh. S.

USSR/Nuclear Physics - Mesons

Jun 52

"Birth of Slow Mesons in the Glass of Photoplates,"  
Zh. S. Takibayev, B. K. Kazieva, Phys-Tech Inst,   
Acad Sci Kazakh SSR

"Zhur Eksper i Teoret Fiz" Vol XXII, No 6, pp 783,  
784

Author describes his exptl work with cosmic rays  
on Mount Pamir (4,700 m). He concludes that addnl  
mesons are produced within the glass of photoplates;  
therefore in his research he now uses photoemulsions  
without glass background. Letter to the editor,  
received 28 Mar 51.

217T88

1. TAKIRAYEV, ZH. - OSTYAKOV, M. - KAYCOV, D.
2. USSR (600)
4. Cosmic Rays
7. Absorption of star-forming component of cosmic rays at a height of 4,000 meters. Zhur.eksp.i teor.fiz 23 no. 4, 1952
9. Monthly List of Russian Accessions, Library of Congress, March 1953, Unclassified.

USSR/Nuclear Physics - Cosmic Rays

Nov 52

"Generation of Star-Forming Particles in Dense Substance at Altitude of 25 Kilometers," Zh. S. Taki-bayev, Phys Tech Inst, Acad Sci Kazakh SSR

"Zhur Eksper i Teoret Fiz" Vol 23, No 5, pp 543-551

Describes results of treatment of photographic plates exposed in the stratosphere under various layers of absorbing lead. Discusses the possibility of explanation of transitory effect between "stars" and single traces of heavy particles. Indebted to K. S. Bogomolov, A. A. Sirotinskaya, M. I. Podgoretskiy. Received 30 Jun 52.

236T75

TAKIBAEV, Zh. S.

"Introduction of a thin-filament into the photo-emulsion for the investigation of nuclear fission processes." by Zh. S. Takibaev (p 223)

SO: Zhurnal Eksperimentalnoi i Teoreticheskoi Fiziki, 1953  
Vol 24 #2

TAKIBAYEV, Zh. S.

USSR/Nuclear Physics - Photography

FD-494

Card 1/1 : Pub. 146-11/18

Author : Takibayev, Zh. S.

Title : Introduction of fine particles of matter into the emulsion of thick-layer photoplates

Periodical : Zhur. eksp. i teor. fiz., 24, 229-232, Feb 1953

Abstract : For investigation of interaction of cosmic rays with nuclei of various substances the author suggests the introduction of fine particles of these substances of spherical shape as obtained by electric spark method into the emulsion of thick-layer photoplates. Discusses various methods of introduction of such particles into the emulsion. Indebted to K. S. Bogomolov and A. A. Sirotinskaya. 4 references, including 1 foreign.

Institution : Physico-Technical Institute, Acad Sci Kazakh SSR

Submitted : April 7, 1952

AKHIEZER, Zh. S.

USSR/Nuclear Physics - Photography

FD-495

Card 1/1 : Pub. 146-12/18

Author : Takibayev, Zh. S.

Title : Introduction of a thin thread into the photoemulsion for the study of nuclear fission

Periodical : Zhur. eksp. i teor. fiz., 24, 233-236, Feb 1953

Abstract : Uses a fine thread to study nuclear fission within it by means of thick layer photoplates. The suggested method consists in introduction of the thread into the emulsion by squeezing it between photographic plates. The thread is removed before chemical treatment of the photoplate. The survey is conducted along the traces of the thread, which substantially facilitates the studies.

Institution : Physico-Technical Institute, Acad. Sci. Kazakh SSR

Submitted : April 7, 1952



TAKIBAYEV, L.H.

6273

DETERMINATION OF THE EXACT MOMENT WHEN  
CHARGED PARTICLES ARE RECORDED IN A PHOTO-  
GRAPHIC PLATE. Zh. S. Takibayev. Zhur. Eksp'l. i

Teoret. Fiz. 24, 363-4(1953) Mar. (In Russian).

The suggested method consists in placing two plates with emulsions turned toward each other, the lower plate beginning to rotate slowly at a moment  $T_0$ . After one full rotation, the clockwork mechanism displaces the upper plate by  $\Delta r$ . This rotation with superposed displacements lasts until time  $T$ . Any moment  $t$  (between  $T_0$  and  $T$ ) can be obtained from the equation  $T-t = (1 + \frac{\varphi + \varphi_0}{2\pi})/\omega$ , where  $l$  is the number of displacements,  $\varphi_0$  and  $\varphi$  are azimuths of the track in the upper and lower plate, respectively, and  $\omega$  is the angular speed of rotation. (Science Abstracts)

Rm2  
4-11-55

TAUBAYEV, Sh. G.

"A New Photometric Method for Measuring the Density of the Track of Particles in a Photographic Plate Emulsion," Vest. Akad. Nauk. Kaz. SSR, No 3, 1954, pp 74-76

Proposes a method of measuring the density of grains in the track on a photographic plate. Method is based on an optical device consisting of a fine line superimposed on a narrow slit. The linear component of the track density is measured by the difference in light intensity when the line in the slit covers the track and causes a corresponding deflection in the photomultiplier galvanometer. (RZhKhim, No 18, 1954)

St: Sum. No. 568, 6 Jul 55

TAEIBAYEV, Zh. S.

"Measurement of Mass of Particles and Determination of Correlation Between Their Energy and Their Trace in Photoemulsions".

Vestn. AN Kaz SSR, No 9, pp 101-110, 1954

Three methods are described: (a) from the residual trace and the grain density; (b) from the grain density and the mean angle of multiple scattering; (c) from the residual trace and the mean angle of multiple scattering. The advantages and deficiencies of each method are mentioned. A method for determining the constants  $c$  and  $\gamma$  in the empiric formula expressing the ratio of path to energy:  $E \propto R^2$  is suggested. A method for evaluation of errors of measurements and of the inaccuracy of the microscopic table is presented. (RZhFiz, No 10, 1955)

SO: Sum No 812, 6 Feb 1956

TAKIBAIEV, Zh. S.

USSR/ Physics

Card 1/1 : Pub. 123 - 11/17

Authors : Takibaev, Zh. S., Cand. in physico-math. scs.

Title : A new photometric method of measuring a particle's track in photo-emulsions

Periodical : Vest. AN Kaz. SSR 11/3 (108), 74-76, Mar 1954

Abstract : A new method of measuring particle tracks in a photo-emulsion is described. This method is new in that a binocular attachment is used on the microscope through which the tracks of the particles are observed; then, the method of compensations is applied. Nine references (1948-1952). Diagrams.

Institution : ...

Submitted : ...

TAKIBAYEV, ZH. S.

# USSR.

882. Application of the phenomenon of light interference for determining the "noise level" of the microscope stage. ZH. S. TAKIBAYEV AND V. N. SHAKHVERDISTOV. Letter in *Zh. eksper. teor. Fiz.*, 26, No. 4, 307-8 (1954) In Russian.

The measured mean angle of multiple Coulombic scattering of emulsion particles (used in the investigation of cosmic radiation) differs from the true angle by the mean angle of spurious scattering, the latter being due to different causes: experimental error, asymmetry of grain distribution, and deviations of the mechanical (co-ordinate) microscope stage from rectilinear motion. The value of this deviation is called the "noise level," and a method is described for its determination with the use of Innik's micro-interferometer and a plane mirror attached to the stage at an angle of  $\phi = w/2$  (where  $w$  is the convergence angle of the interference rays). The magnitude of the "noise level" is given by the value of displacement (in  $\mu$ ) of the interference image. The method suggested is sensitive to variations in temperature and humidity and to accidental vibrations.

F. LACHMAN

28

USSR/Physics - Photography

FD-1497

Card 1/1 : Pub. 146-20/20

Author : Mironenko, Yu. P., and Takibayev, Zh. S.

Title : New method of photometry of particle traces in photoemulsion

Periodical : Zhur. eksp. i teor. fiz., 27, 390-391, Sep 1954

Abstract : Attempt to improve methods of counting the grains of photoemulsion along a particle trace by electronic means. Outline their own device, also described in Vestn. AN. Kazakh SSR, March, 84, 1954. Five foreign and above USSR references.

Institution : Physicotechnical Institute, Acad Sci Kazakh SSR

Submitted : April 29, 1954

TAKIBAEV, Zh. S.

Transition effect for stars and its connection with the cascade multiplication of particles of the nucleon component. Zh. S. Takibayev. Bull. Acad. Sci. U.S.S.R., Phys. Ser. 6, 630-7 (1955) (English translation). — See C.A.B. 50, 7917f.

U.S.S.R.

Rmf  
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TAKIBAYEV, Zh. S.

4001-Pme

4729

SOME RESULTS OF THE INVESTIGATION OF SPALLATION OF W, Cu, AND Al. BY COSMIC RAYS. Zh. S.

Takibayev, (Physico-Technical Inst. Kaz. S.S.R.). Izvest. Akad. Nauk S.S.R. Ser. Fiz. 19, 541-5 (1955) Sept.-Oct. (In Russian)

Tungsten, copper, and aluminum wires of 50 to 200 $\mu$  were used in the investigation of nuclear spallation in pure elements. The wires were placed in a single, parallel row and pressed between the photoplates of the emulsion facing each other. The photoplate emulsion thickness was about 1200 to 1500 $\mu$  and the total thickness of the photoplate pile was 5 cm. After the photoplate and film exposure to the cosmic rays on mountain peaks or in the stratosphere the wires were removed and the plates and films were developed under various conditions. Diagrams and tables of the distribution of the stars formed in W, Cu, Al and the number of gray traces ( $N_g$ ) in relation to the total number of prongs ( $N_p$ ) of the star are given. The measurements were made at the elevation of 4375 m and in the stratosphere. (R.V.J.)

*Handwritten notes and signatures:*  
Pme  
Pme



TAKIBAYEV, Zh.S.

Transition effect for "stars" and its relation to the cascade multiplication of nucleon component particles. Izv.AN SSSR.Ser.fiz.19 no.6: 687-696 N-D '55.  
(MLRA 9:4)

1.Fiziko-tekhnicheskiy institut Akademii nauk Kaz.SSR.  
(Cosmic rays) (Nuclear physics)

TAKIBAYEV, Zh. S. Doc Phys-Math Sci -- (diss) "Formation of secondary  
star-forming particles and the generation of mesons by cosmic rays."

Alma-Ata, 1957. 14 pp (Inst of Nuclear Physics, Acad Sci Kazakh SSR), 100 copies  
(KL, 4-53, 80)

Name: TAKIBAYEV, Zh. S.

JPRS/DC-280

CSO DC-1912

Dissertation: Investigation of the nature of interactions of cosmic rays  
and atomic nuclei of heavy and light elements

Degree: Doc Phys-Math Sci

*DEFENDED AT:*

~~Affiliation:~~ Physical Inst imeni P. N. Lebedev Acad Sci USSR, Physico-  
technical Inst Acad Sci Kazakh SSR

*PUBLICATION*

~~Defense Date,~~ Place: 1956, Alma-Ata

Source: Knizhnaya Letopis', No 4, 1957

TAKIBAYEV, Zh. S.

Explanation of the transition effect of "stars" in the  
stratosphere. Zh. S. Takibayev. *Soviet Phys. JETP* 3,  
559-63(1956)(English translation).—See *C.A.* 50, 14405i.  
B. M. R.

TAKIBAYEV, Zh. S.

✓ Relative number of  $\alpha$ -particles and protons in stars formed in heavy and light elements. N. N. Lazarev and Zh. S. Takibaev. *Vestnik Akad. Nauk Kazakh. S.S.R.* 12, No. 10, 60-7 (1956); cf. Herzenberg, *C.A.* 49, 14498a. — Expts. with thin fibers of W or Al packed tightly between photographic emulsion layers and raised into the stratosphere by balloons showed that the track stars formed by Al gave a ratio of  $p_{\alpha}/p_p = 0.52$ , and by W 0.31. The angular widening of the particle shower in large stars can be explained by independent collision of a nucleon with those in the nucleus, the  $\pi$  mesons being generated in a series of acts of such interaction (cf. Veksler, *C.A.* 47, 7341h).  
G. M. Kosolapoff

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1/22

7-15  
USSR/Nuclear Physics - Cosmic Rays, C-7

Abst Journal: Referat Zhur - Fizika, No 12, 1956, 34126

Author: Kaipov, D., Takibayev, Zh.

Institution: Physicotechnical Institute, Academy of Sciences Kazakhstan SSR

Title: Formation of Mesons in Nuclei of Pb, Cu, and C Under the Influence of Cosmic Rays in the Stratosphere

Original Periodical: Zh. eksperim. i teor. fiziki, 1956, 30, No 3, 471-476

Abstract: An investigation was made of the cross section of the formation of mesons in various nuclei. It is found that the character of the increase in the cross section of the meson formation at high and low energies is different.

USSR/High Energy Physics - Cosmic Rays, C-7

Abst Journal: Referat Zhur - Fizika, No 12, 1956, 34127

Author: Takibayev, Zh. S.

Institution: Physicotechnical Institute, Academy of Sciences Kazakhstan SSR

Title: On the Explanation of Transient Effects for "Stars" in the Stratosphere

Original Periodical: Zh. eksperim. i teor. fiziki, 1956, 30, No 4, 713-718

Abstract: An explanation is given for the transition curves for nuclear splittings of the "star" type on the basis of consideration of the cascade multiplication of nucleons. It is shown that noticeable transient effects for stars should be observed in altitudes above 15 km above the sea level also in the case of application of absorbers made of heavy elements, and this is in agreement with experimental results. In the case of absorbers made of heavy elements it is necessary to take into account the excess number of neutrons above the number of protons in the nucleus.

1 of 1

- 1 -

TAKIRAYEV, Zh.S.

Investigation of the nature of interactions of cosmic rays with  
atomic nuclei of heavy and light elements. Trudy Inst.iad.fiz.  
AN Kazakh.SSR 1:3-159 '58. (MIRA 12:2)  
(Nuclei, Atomic) (Cosmic rays) (Nuclear reactions)



SOV/120-59-1-12/50

AUTHORS: Chasnikov, I. Ya., Takibayev, Zh. S., Boos, E. G.

TITLE: Determination of the Energy of Relativistic Particles from Measurements on Multiple Coulomb Scattering (Opredeleniye energii relyativistskikh chastits po izmereniyu mnogokratnogo kulonovskogo rasseyaniya)

PERIODICAL: Priroda i tekhnika eksperimenta, 1959, Nr 1, pp 54-57. (USSR)

ABSTRACT: The quantity which is measured directly is the second difference in coordinates given by:

$$\bar{D}^2 = \bar{D}_{\text{coul}}^2 + n^2 \quad (1)$$

where  $\bar{D}_{\text{coul}} = Kt^{3/2}/p\beta c$ ,  $K$  is a constant and  $n$  is given by  $n^2 = \bar{D}_{\text{st}}^2 + \bar{D}_{\text{noise}}^2$ . The quantity  $\bar{D}_{\text{noise}}$  gives all the possible errors associated with measurements on the microscope (Ref 3). It may be shown (Ref 6) that for large cells  $n = at^x$  so that:

$$\bar{D}^2 = (K/p\beta c)^2 t^3 + a^2 t^{2x} \quad (2)$$

Card 1/4

30V/120-59-1-12/50

Determination of the Energy of Relativistic Particles from Measurements on Multiple Coulomb Scattering

In Eq (2) there are three unknowns, namely, the momentum  $P\beta c$  and the quantities  $a$  and  $x$ . To determine them it is necessary to have three equations corresponding to three cell sizes  $t$ . Such a system of equations is most conveniently solved in the case of cells whose lengths are in the ratio 1:2:4 so that:

$$\begin{aligned} \bar{D}_1^2 &= (K/P\beta c)^2 t_1^3 + a^2 t_1^{2x} , \\ \bar{D}_2^2 &= 3(K/P\beta c)^2 t_1^3 + a^2 2^{2x} t_1^{2x} , \\ \bar{D}_4^2 &= 6(K/P\beta c)^2 t_1^3 + a^2 2^{2x} 2^{2x} t_1^{2x} \end{aligned} \quad (3)$$

Solution of the above three equations gives:

Card 2/4

SOV/120-59-1-12/50

Determination of the Energy of Relativistic Particles from Measurements on Multiple Coulomb Scattering

$$p_{BC} = Kt_1^{3/2} \sqrt{\frac{64\bar{D}_1^2 + \bar{D}_4^2 - 16\bar{D}_2^2}{\bar{D}_1^2\bar{D}_4^2 - \bar{D}_2^4}} \quad (4)$$

By measuring  $\bar{D}_1$ ,  $\bar{D}_2$  and  $\bar{D}_4$ , the momentum of a particle may thus be directly determined. The method will work satisfactorily when the coulomb scattering is of the order of the distortion effect described by  $D_{J1}$ . The latter is due to micro-distortions in the emulsion. The above method was verified using the data obtained in Ref 2 by measuring multiple scattering of 4.5 Gev  $\pi$ -mesons in Ilford G-5 emulsions. The authors report that in this case the method works satisfactorily. Other measurements have shown that the method will work up to 20 Gev if tracks 4-5 cm in length are available. There are 4 figures and 9 references, of which 5 are Soviet, 1 is

Card 3/4

SOV/120-59-1-12/50

Determination of the Energy of Relativistic Particles from Measurements on Multiple Coulomb Scattering

English and the rest are Italian.

ASSOCIATION: Institut yadernoy fiziki AN KazSSR (Institute of Nuclear Physics, Academy of Sciences, KazSSR)

SUBMITTED: January 4 1956.

Card 4/4

LUKIN, Yu.T.; TAKIBAYEV, Zh.S.

Energy spectra of recoil nucleons from the splitting of the  
nuclei of photographic emulsions. Vest.AN Kazakh.SSR 15 no.1:  
78-85 Ja '59. (MIRA 12:1)

(Photography, Particle track)  
(Cosmic rays)

TAKIBAYEV, Zh S.

CARD 1 / 2

PA - 1981

SUBJECT USSR / PHYSICS  
AUTHOR TAKIBAEV, Zh.S., USIK, P.A., ANTONOVA, M.G.  
TITLE On the Problem of the Production of Pions by High Energy Particles of Cosmic Radiation.  
PERIODICAL Dokl. Akad. Nauk 111, fasc. 2, 341-344 (1956)  
Issued: 1 / 1957

The slight dependence of the number of thin traces in showers with small aperture angle on the nuclear charge number of the nuclear target does not suffice for the solution of the problem as to the correctness of any theory.

The authors investigated showers with close and also with wide aperture angles of shower particles. These showers were produced on the occasion of the interaction between high-energy cosmic particles and the atomic nuclei of the photoemulsions (exposed in the stratosphere). The authors are of the opinion that most of the observed showers cannot possibly be explained by the mechanism of the multiple production of pions by a single collision between the impinging nucleon and one of the nucleons of the target nucleus. Also the hypothesis of the production of mesons by a collision between a particle and a whole "tube" of nucleons cannot serve as an explanation for the observed parameters of the showers.

The showers investigated were selected from among about 40,000 stars in photo-plates. The energy of the primary particle is determined in accordance with the formula  $E_0 = 2Mc^2 / \lg^2 v_{1/2}$ . The value found in this manner is, of course,

Dokl.Akad.Nauk 111, fasc.2, 341-344 (1956) CARD 2 / 2

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the lowest limit of the energy of the primary particle. The experimental data derived from 36 showers are shown in a table. According to these data most showers are not produced by nucleon-nucleon collisions. Therefore the authors compared experimental results with the theory developed by LANDAU and selected a suitable length of the "tube" for each individual case.

In many cases showers can be treated as the result of a collision between an impinging nucleon and "nuclear tubes" of different lengths (according to the theory by LANDAU, which was further developed by S.Z.BELEN'KIJ and G.A.

MILECHIN, Zhurn.eksp.i teor.fis.29, 20 (1955)). However, the aperture angle  $\vartheta_{1/2}$  is in the case of some showers considerably greater than the predicted value of  $\vartheta_{1/2}$  which is predicted by the theory in the case of a given  $n_s$

(the significance of this shower parameter is not mentioned). Such an extension can be due to the forming of a cone instead of a cylinder in nuclear matter or by the scattering of shower particles by nucleons before leaving the nucleus. The showers with  $\vartheta_{1/2} < 10^\circ$  are explained in a formally satisfactory manner by the hydrodynamic theory. In the case of broad showers ( $\vartheta_{1/2} > 15^\circ$ ) the observed high value of  $\vartheta_{1/2}$  cannot well be explained by the theory. The data obtained in the course of the present work rather point in the direction of the existence of a multiple production process of mesons.

INSTITUTION: Physical-Technical Institute of the Academy of Science of the SSR KAZAKSTAN.

ТАКИБАЕВ, З. С.

"Investigation of Showers Formed in a Photographic Emulsion by Cosmic Ray Particles in the Stratosphere," by Zh. S. Takibayev, Vestnik Akademii Nauk Kazakhskoy SSR, No 1 (142), Jan 57, pp 70-88

The article analyzes a set of showers chosen from over 40,000 stars formed in photographic emulsions. The emulsions were exposed to cosmic rays in the stratosphere "on the latitude of Moscow."

It is noted that "analysis of many cases of showers formations ... during 1954-55 leads us to the conclusion that a considerable number of the observed showers cannot possibly be explained solely as a process of multiple  $\pi$ -meson production due to a nucleon-nucleon collision. This is particularly true for primary particles with energies in the range 10-1,000 Bev."

Data are presented on 56 showers, which are analyzed from the position of the theory of multiple meson production and the "repeated multiplication theory of meson production," where several mesons can be formed in each nucleon-nucleon collision and where this process can occur several times within the limits of the same nucleus.

The repeated multiplication theory gave a "more satisfactory explanation" of the data. (U)

Sum. 1360



FAKIBAYEV, Z.H.S.

Distr: 4E3g

Energy spectra of nucleons obtained by splitting of tungsten and aluminum nuclei. B. G. Boos, Yu. T. Lukin, Zh. S. Takibaev, and I. Ya. Chesnikov. *Vestnik Akad. Nauk Kazakh. S.S.R.* 13, No. 7, 101-3 (1957) (in Russian). The investigation is concerned with the study of the energy balance when W and Al nuclei are split by cosmic rays. Primary and secondary effects have been considered. Nucleons originating from W have an av. energy of 51 m.e.v. and from Al 55 m.e.v. Tracks of  $\pi$  mesons were found in W and Al, although their no. was only near 1% of that of proton tracks.

A. Kremheller

7-8m  
JR 8m

120-4-5/35

AUTHORS: Lukin, Yu.T., Takibayev, Zh.S. and Chastnikov, I.Ya.

TITLE: An Investigation of the Distortion Produced in Nuclear Emulsions by the Introduction of Threads into Them.  
(Issledovaniye iskazheniy v yadernykh emul'siyakh, vnosi-  
mykh utoplennymi nityami)

PERIODICAL: Priory i Tekhnika Eksperimenta, 1957, No.4,  
pp. 27 - 29 (USSR).

ABSTRACT: There are a number of methods of introducing a material into an emulsion: 1) The emulsion may be loaded with the material in the form of a suspension when still in the liquid state (Ref.1). 2) A thin foil can be placed between prepared emulsion layers (Ref.2). 3) Thin metallic threads can be placed into the emulsion when it is still in the liquid state (Ref.3 and 4). The present work is devoted to the determination of distortions introduced into emulsions by the inclusion of thin metallic threads or filaments.  $660 \pm 5$  MeV protons were used to irradiate emulsions with and without metallic threads and the distortion was determined by comparing the scattering of these protons in the two kinds of emulsion. At the same time, the "scattering constant" for the emulsion NIKFI (type P) which was used in the above work was also determined. This was

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120-4-6/35

An Investigation of the Distortion Produced in Nuclear Emulsions  
by the Introduction of Threads into Them.

found to be equal to  $27.4 \pm 1.5^0$ . MeV (100  $\mu$ )<sup>1/2</sup>. This  
value is in good agreement with the values obtained by  
other authors for the widely used Ilford G-5 emulsion.  
There are 1 table and 9 references, 3 of which are Slavic.

ASSOCIATION: Physico-technical Institute of the Ac.Sc. Kazakh  
SSR (Fiziko-tekhnicheskii institut AN Kaz. SSR)

SUBMITTED: December 27, 1956.

AVAILABLE: Library of Congress

card 2/2

21(8)

PHASE I BOOK EXPLOITATION SOV/1316

Akademiya nauk Kazakhskoy SSR. Institut yadernoy fiziki

Trudy, t. 1 (Transactions of the Institute of Nuclear Physics,  
Kazakh SSR Academy of Sciences. v.1) Alma-Ata, Izd-vo  
AN Kazakhskoy SSR, 1958. 2,000 copies printed.

Ed.: Osadchiy, F. Ya.; Tech. Ed.: Alferova, P.F.; Editorial  
Board of Series: Griman, I.G., I.G. Dem'yanikov (resp. ed.),  
T.P. Diogenova, and S.K. Kalinin.

PURPOSE: This volume of the "Trudy" is intended for specialists  
(Physicists, physicochemists, physicist-metallurgists, etc.),  
scientists, engineers, teachers, and postgraduate students  
(aspiranty).

Coverage: This volume of the "Trudy" contains results of research  
performed at the "Institut yadernoy fiziki" (Institute of Nuclear  
Physics) in the years 1954-1956. The first article is concerned  
with the interaction of cosmic-ray particles with nuclei of

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Transactions of the Institute (Cont.)

SOV/1316

various substances, and with the nature of secondary particles. Particular attention is given to the generation of mesons in showers. The next article discusses the motion of charged particles from the point of view of the general theory of re-lativity. A series of articles presents the problems of changes in the plasticity, strength, and hardness of alloys at various temperatures in relation to their chemical and phase compositions. Data are given on the properties of alloys during crystallization with reference to hot-shortness. Separate problems of the theory of shaping are also included. Spectrum analysis is discussed as applied to the study of arc performance and to the determination of rare earth elements in minerals. The text also describes quantitative x-ray spectrum analysis based on the various spectrum series.

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4-6-59

LOKTIONOV, A.A.; STAFYEV, V.I.; TAKIBAYEV, Zh.S.

Studying the spatial distribution of nuclear disintegrations with  
thick nuclear emulsions. Vest.AN Kazakh.SSR 14 no.10:49-59 0 '58.  
(Cosmic rays) (Photography, Particle track) (MIRA 11:12)

SOV/ 56-34 -3-13/55

AUTHORS: Noos, D. G. , Vinit'skiy, A. Kh. , Takibayev, Zh. S. ,  
 Chasnikov, I. Ya.

TITLE: The Investigation of a Shower Produced by a Singly Charged  
 Particle of High Energy (Issledovaniye livnya, vyzvannogo  
 odnozaryadnoy chastitsey vysokoy energii)

PERIODICLA: Zhurnal Eksperimental'noy i Teoreticheskoy Fiziki, 1958,  
 Vol. 34, Nr 3, pp. 622 - 631 (USSR)

ABSTRACT: The case described here of the type (2 + 16 p) was observed  
 in a 600  $\mu$  thick emulsion Ilford G-5, which in 1955 was  
 exposed in Italy at an altitude of about 30 km. The energy of  
 the primary particle which was estimated by the usual kine-  
 matic method was  $(5^{+10}_{-3}) \cdot 10^{12}$  eV. The shower particles moved  
 within an angle of  $1.7 \cdot 10^{-1}$  rad. The central traces pass in  
 a plate distances up to 5 cm. For this very reason the ener-  
 gy of 15 shower particles could be determined by immediate  
 measurement of the multiple Compton scattering. The first:

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The Investigation of a Shower Produced by a Singly Charged Particle of High Energy

paragraph discusses the measurement of the momenta of the secondary particles. The scattering was measured individually for all shower particles. The value  $D$  of the scattering, which was measured immediately in the experiment, is composed of the pure Coulomb scattering  $D_c$  and of the scattering  $n$ , which is caused by all the other factors. The quantity  $n$  can be measured by measurement of the scattering of a high energy particle at three cells along its trace. The scattering of the shower particles was measured at cells from 500 to 4000  $\mu$ . The next paragraph deals with the angular distribution and the energy distribution of the shower particles. The angular distribution of the shower particles is illustrated by a diagram. This angular distribution agrees best with distribution according to the Heisenburg theory. . To compare the energy distribution of the shower particles with the theory by Landau a histogram was constructed in the laboratory coordinate system. The here found energy distribution does not correspond with the Landau theory, for a predominance of the low energy shower particles compared with the expected theoretical values is observed. The measured energy of the particles is smaller by one order of magnitude than the the corresponding theoretical values. A diagram illustrates the energy distribution of

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SOV/56-34-3-13/55  
The Investigation of a Shower Produced by a Singly Charged Particle of High Energy

15 shower particles in the center of mass system. This curve corresponds to the energy spectrum of the Heisenberg theory. The coefficient of the non-elasticity in the center of mass system amounts to  $0.10^{+0.06}_{-0.02}$ . The shower investigated here

obviously has been generated by a nucleon-nucleon collision. The third paragraph discusses the soft component which accompanies the shower. To study this soft component the emulsion was evaluated inside a cone with the half aperture angle of 0.15 rad relatively to the shower axis. In this volume 10 electron-positron pairs and 1 trident were found. The corresponding data are compiled in a table. In case of knowledge of the number of the primary electron-positron pairs, which accompany a given shower, the expected number of neutral pions can be computed by application of the law of radioactive decay; a corresponding formula is written down here. For the mean energy of the neutral pions the value  $15 \pm 3$  BeV is found. There are 6 figures, 4 tables, and 14 references, 4 of which are Soviet.

Card 3/4

AUTHOR KAIPOV, D.K., ~~TAKIBAYEV~~, Zh.S. 56-4-8/52  
TITLE The Generation of Slow  $\pi$ -mesons by particles of Cosmic Radiation.  
(Generatsiya medlennykh  $\pi$ -mezonov chastitsami kosmicheskikh luchey.-  
Russian)  
PERIODICAL Zhurnal Eksperim.i Teoret.Fiziki, 1957, Vol 32, Nr 4, pp 690-696 (U.S.S.R.)  
Received 7/1957 Reviewed 8/1957  
ABSTRACT It was established that probably the generating particles are neutrons  
of cosmic radiation. It is necessary to investigate the flux of  $\pi$ -me-  
sons which are generated from the air and surrounding dense absorbers.  
For this purpose experiments were carried out on the summit of a moun-  
tain of 4000 m height. A pair of photoplates was exposed in the course of  
2 months on a mast of 2 m height, and a second pair was exposed in immed-  
iate contact with the surface of the ground. After chemical treatment  
(development and fixing) these plates were examined under a microscope.  
From table 1 it may be seen that the amount of  $\pi$ -mesons observed on the  
photoplates which had been exposed on the ground is (from five to six ti-  
mes) greater than that of the plates exposed on the mast. It follows here-  
from that when investigating the generation of slow  $\pi$ -mesons by cosmic  
radiation, all experimental emulsions must, if possible, be removed from  
absorbers. Further, electron-sensitive photoplates of the NIKFI type we-  
re exposed in the stratosphere in an altitude of from 25 - 27 km and on a  
mountain (high 2.5 km). The results obtained by the exposure of 2 plates  
in the stratosphere and one on a mountain are shown in table 2, which  
contains also  $p$ -mesons. Not all  $p$ -mesons are also  $u$ -mesons. A part of the

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The Generation of Slow  $\pi$ -mesons by Particles of Cosmic Radiation. 56-4-8/52

negative  $\pi$ -mesons ( $\sim 2\%$ ) produces no visible stars, which are contained in the number of p-mesons. Table 2 shows that the number of slow mesons rises with an increase of the strength of the lead absorber if the number of u-mesons does not depend on the modification of the strength of the lead at all. The number of nucleons plays an important part with respect to the dependence of the pier section of the generation of slow mesons on the atomic weight of the absorbers. The generation section of the  $\pi$ -mesons diminishes with an increase of the atomic weight of the substance of the target, because in an altitude of 3240 m the greater part of the protons ( $\sim 90\%$ ) has an energy that is less than 1 BeV, and only  $10\%$  can be ascribed to protons with energies above 1 BeV. It is to be presumed that the neutrons of cosmic radiation have the same energy in these altitudes. Herefrom it may be seen that the average energy of the nucleons of cosmic radiation in these altitudes is only a little more than the energy of protons. The cross section of the generation of  $\pi$ -mesons at a proton energy of  $\sim 400$  MeV is proportional to the geometric cross section of the nucleus. A special experiment was carried out on the top of a mountain (2500 m) with an exposure of 2 months. Thin absorbers of lead and aluminum and photoemulsions of the NIKFI type with a thickness of  $400\mu$  were used. The absorbers were cylindrical. From the results, as shown by table 3 it may be seen that the number of  $\pi$ -mesons decreases to a smaller extent than was expected.

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The Generation of Slow  $\pi$ -Mesons by Particles of Cosmic Radiation. 56-4-8/52

For the purpose of explaining the nature of meson-generating particles the dependences on altitude of their generation was investigated. Photo-emulsions were exposed in various altitudes which were covered with a lead layer of 2 cm thickness. Of all stratospheric flights undertaken for the determinations of the dependence on altitude of the generation of  $\pi$ -mesons only such flights were utilized in the case of which the time of drift exceeds the time of the ascent and the descent of the apparatus by the four-fold. In conclusion results obtained in connection with positive and negative  $\pi$ -mesons are discussed. Herefrom information is also obtained concerning the nature of generating particles. All regular processes are easily to be explained if one assumes that the major part of the slow mesons is formed by neutrons. The participation of protons in the formation of  $\pi$ -mesons increases with the increase of the energy of  $\pi$ -mesons.

ASSOCIATION	Physical Institute of the Academy of Science of the U.S.S.R.
PRESENTED BY	
SUBMITTED	20.7.1956
AVAILABLE	Library of Congress
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AUTHOR TAKIBAYEV, ZH. S., USIK, P.A. 56-4-35/52  
 TITLE Taking Account of the Primary  $\alpha$ -Particles during the Development of a Nucleon Cascade in the Stratosphere.  
 (Uchet pervichnykh  $\alpha$ -chastits v razvitii nuklonnogo kaskada v stratosfere.- Russian)  
 PERIODICAL Zhurnal Eksperim. i Teoret. Fiziki 1957, Vol 32, Nr 4, pp 924 - 925 (USSR)  
 ABSTRACT According to the opinion of H.L.BRADT and B.PETERS, Phys. Rev. Vol 77,54 (1950), 45 % of the nucleons impinge upon the boundary of the atmosphere in form of protons, 45,3 % as part of the  $\alpha$ -particles, and 9,7 % in form of heavy nuclei. These primary protons  $\alpha$ -particles and heavy nuclei possess up to 4000 Mc<sup>2</sup> similarly formed energy spectra (with respect to the energy of a nucleons). The same exponents as for primary protons can therefore be selected when taking account of the influence exercised by the  $\alpha$ -particles in the formula for their spectrum. For the case of the computations discussed here the average amount y of the star-forming nucleons on the occasion of the fission an air nucleus by a primary  $\alpha$ -partioles is put equal to 2,5. On the basis of various experimental results the behavior of the nucleons of a primary  $\alpha$ -particle in the target nucleus may even for the energies

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Taking Account of the Primary  $\alpha$ -Particles during the Development of a Nucleon Cascade in the Stratosphere.

investigated here be looked upon as independent of one another (i.e. the nucleons of the primary  $\alpha$ -particle apparently react independently of one another). According to the opinion of the authors the model of the independent interaction of the impinging nucleons with the nucleons of the target nucleus may therefore be used. For the computations discussed here the mesons, secondary  $\alpha$ -particles and the energy losses of the charged particles due to ionization are not taken into account. If the intensity of the primary protons is normalized to 1, the following formula is obtained for the differential spectrum of the  $\alpha$ -particles:

$$S(E_0)dE_0 = \begin{cases} 0,3 \gamma E_c^\gamma E_0^{-\gamma-1} dE_0 & \text{for } E_0 \gg E_c = 740 \text{ MeV} \\ 0 & \text{for } E_0 < E_c \end{cases}$$

Here  $E_0$  and  $E_c$  denote the energies per nucleon and  $\gamma = 1,1$  is true. The authors computed the curves for the star-forming particles with energies of more than 100 MeV for various atmospheric depths. Computations were carried out with and

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56-4-35/52

APPROVED FOR RELEASE: 07/13/2001

CIA-RDP86-00513R001754720015-9"

Development of a Nucleon Cascade in the Stratosphere.

without taking account of the primary  $\alpha$ -particles and results are shown in a diagram.  
(1 Illustration)

ASSOCIATION: Physical-Technical Institute of the Academy of Science of the Kazakh S.S.R.

PRESENTED BY: -

SUBMITTED: 24.2. 1956

AVAILABLE: Library of Congress.

CARD 3/3

AUTHOR: Taktayev, Ch. S. SOV. 51-35-1-35/59

TITLE: An Estimation of the Energy of the Shower-Generating Particles in Consideration of Their Energy Spectrum (Otsenka smacheniya energii livnesobraznyushchikh chastits s uchetom ikh energeticheskogo spektra)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1958, Vol. 35, Nr 1, pp. 277 - 279 (USSR)

ABSTRACT: The possibility of taking account of the energy spectrum of the shower-generating particles in the estimation of their energy (starting from the angular distribution of the secondary particles generated by them) was demonstrated in the course of some discussions. This is possible without using any theory of the multiple production of mesons. The corresponding calculations are given step by step. The author investigated also the distribution of the experimentally observed quantities  $V_i = x_i - \bar{x}$  for a series of showers. The calculations discussed in this paper give the following result: If a shower-generating particle has an energy of 5500 BeV (irrespective of the

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An Estimation of the Energy of the Shower-Generating  
Particles in Consideration of Their Energy Spectrum

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spectrum), this value has to be reduced to 4500 BeV, if  $\sigma^2 \sim 1$ . More exact data concerning the numerical value of the energy of the primary particles and the fluctuation curves will be given in a later paper, which will deal with the investigation of showers observed in a photo-emulsion exposed at high altitudes. There are 3 references.

ASSOCIATION: Institut yadernoy fiziki Akademii nauk Kazakhskoy SSR  
(Institute of Nuclear Physics of the AS of the Kazakh SSR)

SUBMITTED: January 23, 1958

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Author: G. M. L. A., I. A. G. V., Dr. S.,  
 1954, No. 1.

007/01-10-1-7

TITLE: Angular Distribution of Secondary Particles in Showers  
 Produced by High Energy Nucleons (Issledeniye uglevogo  
 raspredeleniya vtorichnykh chastits v livnyakh, obrazu-  
 yemykh nukleonami bol'shoy energii)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1954,  
 Vol 35, No 3, pp 594 - 597 (USSR)

ABSTRACT: In the present paper a formula is given - theoretically  
 for the time being - for the integral and differential  
 angular distributions of shower particles in stars  
 at primary energies of from  $5 \cdot 10^{10}$  to  $10^{12}$  eV. Whereas  
 in the c.m.s.  $N(\theta^*) = \text{const.} d\Omega$ , the formulae for  
 $N(\theta) = g(K, \gamma_c, a, \theta, m)$  for  $m \gg 1$  and  $m \leq 1$  respectively  
 are considerably more complicated. ( $\theta^*$  = solid angle  
 in the center of mass system,  $\theta$  = in the laboratory  
 system)  
 Card 1.5  $a = \gamma_c \tan \theta = \sin \theta^* / (m + \cos \theta^*)$ ;  $m = 3 / \beta^*$ .

Angular Distribution of Secondary Particles in Showers Produced by High Energy Nucleons

$\gamma_0$  is the primary energy of the particles and  $\beta_0$  the velocity of the c.m.s. For the percentage of shower particles  $\epsilon_f$  within  $\theta_f$  it holds that

$$\epsilon_f = \frac{1}{N} \int_0^{\theta_f} N(\theta) d\theta, \text{ where } N \text{ denotes the total number of}$$

particles. The differential angular distribution in the laboratory system for the case of isotropy in the c.m.s. and  $m=1$  the formula

$$\frac{df}{dy} = \frac{df}{da} \frac{da}{dy} = \frac{2 \cdot 10^{2y}}{(10^{2y}+1)^2} \ln 10 \quad y = \lg a \text{ applies}$$

in the anisotropic case, e.g. for  $N(\theta^*) \sim \cos^2 \theta^*$  it holds that  $df/dy = 4 \cdot 10^{2y} (10^{2y}-1) (10^{2y}+1)^{-3} \ln 10$ .

A formula is further given also for the total number of the particles  $N$ . The authors then describe the analysis of the distribution of  $N$  shower in the basis

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Angular Distribution of Secondary Particles in Showers SOV/56-35-3-3/  
Produced by High Energy Nucleons

of the theory of multiple production of mesons in nucleon-nucleon collisions and discuss the connection between  $\theta_1$  and  $n_s$  (Figs 4,5,8). For the theory of multiple productions it differs considerably from that observed by experiment. The experimental  $n_s$  and  $\theta_1$  -

values can be brought into line with theory by assuming a meson production in secondary process (40%) in altitudes of from 30-33 km. There are 9 figures and 8 references, 3 of which are Soviet.

SUBMITTED: March 15, 1958

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21(7)

SOV/56-36-6-11/66

AUTHORS: Loktionov, A. A., Takibayev, Zh. S.

TITLE: Production of  $\pi$ -Mesons by  $\alpha$ -Particles of High Energy From Cosmic Radiation (Generatsiya  $\pi$ -mezonov  $\alpha$ -chastitsami bol'shoy energii kosmicheskikh luchey)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1959, Vol 36, Nr 6, pp 1697 - 1702 (USSR)

ABSTRACT: In collisions of high-energy ( $E \cdot 10^{12}$  ev) nucleons with atomic nuclei it may be assumed that the nucleons interact with a "pipe" of massive nuclear matter; the diameter of this "pipe" is equal to that of a nucleon, its length depends on the atomic number of the target nucleus and the collision parameter. On the basis of this theory it is possible to explain some experimental data of high-energy showers; the authors of the present paper use it for the purpose of investigating the collision of  $\alpha$ -particles and atomic nuclei, where the "pipe" has a diameter that is proportional to  $A_u^{2/3}$  and contains  $A_\alpha$ -particles. For the investigation the authors used data obtained from showers produced by  $\alpha$ -particles in Ilford G-5 photoemulsions (exposure 1955 in Italy at an altitude of

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Production of  $\pi$ -Mesons by  $\alpha$ -Particles of High Energy  
From Cosmic Radiation

SOV/56-36-6-11/66

30 km; total of 67 showers, c.f. references 5-12). The data are dealt with by means of the hydrodynamical theory of multiple meson production according to Landau and Belenkiy (Refs 13,14). First, the connection between the angle  $\theta_{1/2}$  and the number of charged shower particles is investigated (Fig 1). In heavy nuclear emulsions the maximum size of the "pipe" is 4.57 and in light elements 2.00; in the following the ratio  $N_1/N_2$  both for showers produced by  $\alpha$ -particles and for showers produced by nucleons is investigated and compared. ( $N_1$  denotes the number of interactions of  $\alpha$ -particles with "pipes" having a length of between 2.0 and 4.57,  $N_2$  - the number of interactions with a "pipe"  $< 2.0$ ). In the following the energy distribution of the showers with respect to the number of gray-black tracks  $N_h$  is investigated (Fig 2). The distribution has a maximum at  $3 < N_h < 5$ ; the highest experimentally determined  $N_h$ -value is 26, and for light nuclei it is about 8. The ratio between the cases with  $N_h > 8$  and the cases with  $N_h \leq 8$  is 0.64. This

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Production of  $\pi$ -Mesons by  $\alpha$ -Particles of High Energy  
From Cosmic Radiation

SOV/56-36-6-11/66

ratio is investigated for various energies of  $\alpha$ -particles (10,  $> 10$ ,  $> 50$ ,  $> 100$  Bev/nucleon) (Table 2). Finally, the mean value  $\bar{N}_h$  is investigated in dependence on the length of the "pipe" and on  $\alpha$ -energy (Table 3). An analysis of experimental star data was found not to contradict the concept of an interaction between the incident  $\alpha$ -particles and such a "pipe". There are 2 figures, 3 tables, and 18 references, 8 of which are Soviet.

ASSOCIATION: Institut yadernoy fiziki Akademii nauk Kazakhskoy SSR (Institute of Nuclear Physics of the Academy of Sciences of the Kazakhskaya SSR)

SUBMITTED: February 13, 1958 (initially) and January 20, 1959 (after revision)

Card 3/3

TAHI AYEV, et al.

AN ANALYSIS OF THE ANGULAR DISTRIBUTION OF THIN TRACKS OF SHOWERS PRODUCED BY  $\geq 10^{11}$  EV PARTICLES

Dr. S. Takibayev, A.A. Lektioniv, I.A. Sanko, Ts. I. Shakhova

An analysis is made of the angular distribution of thin tracks of showers produced by cosmic-ray particles with energy exceeding  $10^{11}$  ev. To determine the energy dependence of the angular distribution of the shower-producing particles, all analyzed showers are divided into two energy intervals. The first interval includes all showers produced by particles (protons, neutrons, pions) with energy of the order of  $10^{11}$  ev (at least  $> 10^{10}$  ev); the second interval includes particles with energy exceeding  $10^{12}$  ev. For comparison a study is made of showers taken from published material.

The experimental data obtained are compared with the model of "two Centres" that independently emit mesons (Takagi, Feinberg and Chernavsky, Kokkonen et al). The comparison reveals the limitations of this model. The observed angular distribution of thin tracks of a number of showers may be explained on the assumption that:

- a) there is a power energy spectrum in the centre-of-mass system ( $\sim E^{-1/2}$ ), which agrees with the Heisenberg theory;
- b) there is a sharply anisotropic angular distribution in the centre-of-mass system ( $\sim \cos^2 \theta$ ), although such a high degree of anisotropy of generated particles does not follow from the Heisenberg theory.

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DETERMINATION OF THE ENERGY ( $\sim 10^{11}$  ev) OF PRIMARY  
PARTICLES FROM THE ANGULAR AND ENERGY DISTRIBUTION  
OF SECONDARY SHOWER PARTICLES

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A brief consideration is given to the more common methods of determining the energy of primary cosmic-ray shower-producing particles in individual acts of interaction from the angular distribution of the secondary particles. It is noted that the generally used kinematic methods are based on assumptions which in the majority of cases are not corroborated by experimental data concerning the energy and angular distribution of shower particles.

A method is described of evaluating the Lorentz factor in the center-of-mass system  $\gamma_{cm}$ , in which use is made of the experimentally observed distribution of transverse impulses of secondary particles. The values of  $\gamma_{cm}$  thus obtained coincide (within the limits of errors) with the values of  $\gamma_{cm}$  evaluated from the angular distribution of secondary particles on the assumption of a power ( $\sim 1/E$ ) energy spectrum of the generated mesons. Account of the energy spectrum of secondary particles systematically leads to smaller values of  $\gamma_{cm}$ . Insofar as the distribution of transverse impulses is such that  $\vec{p}_t \sim \sqrt{E}$  (and the separate values of  $p_{t1}$ ).